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HERPES ZOSTER AND THE LIMB PLEXUSES OF NERVES.

HERPES ZOSTER AND THE LIMB PLEXUSES OF NERVES.

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IN the following pages an attempt is made to indicate the cutaneous distribution in the limbs, of nerve fibres connected with the various spinal nerve roots, by a study of the local distribution of the eruption in cases of herpes zoster. After briefly pointing out the intimate association of cutaneous symptoms with visceral disease, the subject will be discussed shortly—(1) with reference to the results obtained by the study of developmental, anatomical, and pathological data; (2) the irregularities in the distribution of the spinal nerves; (3) the main subject of the paper, the delimitation of the cutaneous areas supplied by individual spinal nerves, by a reference to the areas occupied by herpetic eruptions; followed (4) by a brief reference to instances in which the post-mortem examinations have demonstrated the seat of the causal lesion in cases of herpes zoster.

Apart from the anatomical interest in the peripheral distribution of cutaneous nerves, the subject is one of great value from the clinical standpoint. While the areas supplied by the cutaneous nerves in the trunk are fairly well understood, the distribution of those in the limbs is still involved in some obscurity. The exact knowledge of the cutaneous distribution of the limb nerves, in assisting in the diagnosis of the seat of a lesion of the cord, is of the greatest importance. But in a still wider field of observation this same knowledge is a great necessity. The most important symptoms of visceral disease are frequently manifested chiefly or entirely in the cutaneous nerves of the trunk and of the limbs. The intimate association of the nerve supply of the viscera with the roots of the cutaneous nerves undoubtedly indicates the channel by which these symptoms are produced. When the sensory symptoms (pain, hyperæsthesia, etc.) are manifested on the trunk, the connection between the area affected and the diseased organ can usually be made out. But when these sensory symptoms radiate to, or are exclusively localised in, the limbs, the difficulties of diagnosis are increased on account of the absence of exact knowledge as to the distribution of the nerves. For instance, the pain associated with heart disease not infrequently extends into the arm along a definite tract. The tract thus affected is supplied by cutaneous nerves, whose roots are in intimate association with the sympathetic nerves supplying the heart. I have even observed, in aortic disease, pain of the most agonising description, limited entirely to the arm, in the area of cutaneous distribution of the first dorsal nerve. In like manner I have frequently observed disease of the pelvic organs associated with symptoms almost entirely manifested in the distribution of the sacral nerves in the limbs.

For some years I had been trying to trace out the connection between sensory symptoms and visceral disease, and in the course of my observations I was struck by the similarity of the nature and distribution of the sensory symptoms of herpes zoster, with those of visceral disease. Ross, in his very valuable and suggestive paper,[1] had indicated the relationship existing between sensory disorders and visceral disease, and my results supported many of his conclusions.[2] At the time I was making these observations, Head was conducting very minute inquiries into the same subject, and he was also struck by the resemblance of the sensory disorders to those frequently present in herpes zoster.

1. The Results obtained from Developmental, Anatomical, and Pathological Data.

In order to have a clear conception of the distribution of the spinal nerves in the limbs, due regard must be paid to the alterations that have taken place in the relationship of parts in the course of development. To this end Paterson[3] has made numerous careful observations. According to him each spinal nerve may be considered to divide, after the union of the anterior and posterior roots, into a posterior and an anterior primary division. The cutaneous branches of all the posterior primary divisions, when present, may be considered as distributed to skin covering the posterior surface of the trunk,—except in the case of the upper cervical nerves, which do not concern us here. The anterior primary divisions divide into ventral and dorsal branches, and, with reference to the intercostal nerves, these branches are distributed to the lateral and anterior surfaces of the chest and abdomen. In the case of the nerves constituting the brachial plexus, the ventral and dorsal branches of the anterior primary divisions are distributed to the arm, and, in like manner, the ventral and dorsal branches of the nerves constituting the lumbo-sacral plexus are distributed in the leg. The peripheral nerves, after leaving the various plexuses, although they may and usually do contain fibres from two or more spinal roots, with few exceptions contain fibres from the dorsal branches alone, or from the ventral branches alone. It follows, therefore, that although individual spinal nerves are distributed to distinct and definite areas, the ventral and dorsal branches supplying such areas reach their destination by different peripheral nerves.

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[1] Ross, J., "On the Segmental Distribution of Sensory Disorders," *Studies in Anatomy from the Anatomical Department of the Owens College*, 1891, p. 167; and *Brain*, January 1888.

[2] Mackenzie, J., "Contribution to the Study of Sensory Symptoms associated with Visceral Disease," *Medical Chronicle*, Manchester, August 1892.

[3] Paterson, A. M., Articles on "The Limb Plexus of Mammals," "The Morphology of the Sacral Plexus," "The Position of the Mammalian Limb regarded in the light of its Innervation and Development," *Studies in Anatomy from the Anatomical Department of the Owens College*, 1891, and *The Journal of Anatomy and Physiology*, 1887 and 1889.

For the purpose of determining the exact distribution of each individual nerve, careful dissections of the nerves constituting the brachial plexus have been made by Herringham,[1] who was able to define with fair precision the course pursued in their distribution by the nerves involved in the supply of the arm. Ross, on the basis of his pathological observations, confirmed the observations of Herringham and Paterson. From the results of these observers the course of distribution of the nerves, from the fourth cervical to the second dorsal in the arm, and from the first lumbar to the fourth sacral nerve in the leg, may be described as follows:—

The fifth and sixth cervical nerves supply the outer half of the upper arm, the radial half of the forearm, and part of the thumb and index finger. The seventh is distributed to the fingers and hand; the eighth cervical and first dorsal supply part of the middle, ring, and little fingers, the ulnar portion of the hand and forearm, and the inner half of the lower part of the upper arm; and the second dorsal nerve supplies the upper and inner part of the arm. In the leg the course the nerves tend to follow is from the upper and outer part of the hip, supplied by the first lumbar; then round from the outer to the front and inner side of the thigh, inner side of the leg and foot, by the second, third, and fourth lumbar; crossing over to the outer side of the dorsum of the foot and toes, the fifth lumbar is distributed. The outer side of the foot and outer side and back of the leg are supplied by the first, second, and third sacral nerves. The back of the thigh, the perineum, and the under portion of the scrotum are supplied by the third and fourth sacral nerves.

More recently a number of observations of disease and injury to the spinal cord have been collected by Thorburn[2] and Starr,[3] and these confirm in a great measure the foregoing descriptions.

2. THE IRREGULARITIES IN THE DISTRIBUTION OF THE SPINAL NERVES.

The exact delimitation of the cutaneous distribution of an individual nerve can scarely be obtained, on account of the overlapping of neighbouring nerves at the periphery of their areas of distribution. This is very manifest, for instance, where a herpetic eruption may cross the middle line for one or two inches. But it is still more strikingly seen where neighbouring portions of skin are supplied by nerves, the spinal origins of which are very wide apart. Thus, the third and fourth cervical nerves supply the skin over the clavicle and for a short distance down the chest, and the eruption from disease of the third or fourth cervical nerves frequently descends to the breast (Fig. 1); on the other hand, the second dorsal nerve supplies the skin of the upper part of the chest, the herpetic eruption, in its area of distribution, sometimes ascending as high as the clavicle (Fig. 6). I have frequently observed, however, when the eruption is very abundant, that at the edges of the affected tract of skin the vesicles are not so numerous as towards the centre. Hence, it follows that any attempt to depict the cutaneous distribution of nerves by coloured drawings should show the areas of distribution of neighbouring nerves, shading the one into the other. In Heiberg's[1] coloured plates, for instance, the distribution of the cervical nerves on the chest is much more limited in extent than that which nature has mapped out in such cases as those represented by Fig. 1.

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[1] Herringham, W. P., "The Minute Anatomy of the Brachial Plexus," *Proceedings of the Royal Society of London*, 1887, vol. xli., p. 423.

[2] Thorburn, W., "Contributions to the Surgery of the Spinal Cord." London, 1889.

[3] Starr, M. A., "Local Anæsthesia as a Guide in the Diagnosis of Lesions of the Lower Spinal Cord," *International Journal of Med. Sciences*, July 1892.

This overlapping of the nerve supply can be made out by careful dissection. Some years ago I was struck by this fact in some dissections I was making with respect to the nerve supply of the epigastrium. I then adopted the method of preserving the skin intact, and following the nerve twigs to their termination in the skin by carefully removing all the other subcutaneous tissues. I found that the terminal branches from neighbouring intercostal nerves frequently crossed each other. By a similar method, and under water, St. John Brooks has made careful dissections of the nerves of the hand, and has demonstrated that this overlapping takes place to a considerable extent.[2] In the observations of the latter it might be urged, with some show of reason, that the overlapping is merely due to a variation in the number of fibres arising from a spinal root conveyed by the different peripheral nerves. Further, Herringham's results testify abundantly to the fact that the area of skin supplied by any given spinal root is subject to wide variations, although he is able to enunciate the statement that "if a piece of skin is not supplied by the typical nerve the place is filled only by one of its neighbours, and not by a nerve far removed from it in the skin."[3] This variation in the size of the area supplied by a given nerve root was also apparent to Voigt, who, inquiring into the nature of this variation, came to the conclusion that any given area always bears a definite relation to the origin of the nerve in the brain or spinal cord, and that the variations only occur in the course of the nerve from the centre to the periphery.[1]

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[1] Heiberg, J., "Atlas der Hautnervengebiete," Christiana, 1884; also "Atlas of the Cutaneous Nerve Supply of the Human Body," translated and edited by W. W. Wagstaffe. London, 1885.

[2] Brooks, H. St. John, "On the Distribution of the Cutaneous Nerves on the Dorsum of the Hand;" *Internationale Monatsschrift f. Anat. u. Phys.*, 1888, Bd. v., Heft 8.

[3] *Loc. cit.*, p. 434.

This variation of the size of a nerve root applies also to the motor fibres, as illustrated by such dissections as those of Herringham, who found irregularities in the number of muscles supplied by a given nerve root, and also from the physiological experiments of Sherrington, who found that stimulation of an individual nerve root produced contraction sometimes in more muscles in one animal than in another of the same species.[2]

3. The Distribution of the Eruption of Herpes Zoster in the Limbs.

In order to elucidate, if possible, the cutaneous areas supplied by the individual nerves, I made careful observations of the distribution of the eruption in all cases of herpes zoster that came under my own notice. But I found that there were very frequently other symptoms associated with the eruption, such as hyperæsthesia and radiation of pain, which sometimes afforded valuable help in filling up gaps. I also collected such trustworthy accounts of the distribution of the eruption as were to be found in medical literature accessible to me, and altogether, from various sources, I obtained records of over 120 cases of herpes zoster affecting the limbs, where the descriptions were sufficiently clear for my purpose. Little difficulty was found in tabulating these cases, according to the areas affected, in regard to which there was wonderful agreement. The cases selected were mainly those where the disease appeared idiopathically, and was not due to any morbid lesion, central or peripheral (such as myelitis and injuries to peripheral nerves).

The method here adopted to obtain a knowledge of the distribution of the nerves was to observe the situation of the eruption in an area of skin supplied by a nerve whose spinal origin was known, and which was situated high in the cord as the fourth cervical nerve and first lumbar nerve; from such areas, then, to trace, step by step, the areas occupied by eruptions occurring in tracts supplied by nerves whose origins were lower in the cord. No attempt will here be made to define the limits of the eruption by a consideration of the distribution of the peripheral nerves. These are usually made up of bundles from one or more spinal roots, and any such attempt would but obscure the very definite results obtained by looking at the areas supplied by one spinal root. It will very frequently be found, on the one hand, that the area occupied by the eruption is not limited to the distribution of one spinal nerve, and, on the other, that the eruption often manifestly covers but a limited portion of the area supplied by a spinal nerve. The former case is in one sense a matter of difficulty, and in another a source of help. It is helpful, inasmuch as it shows the direction in which the supply of nerves from a higher to a lower centre tends to follow, and it is a source of difficulty because it obscures the areas supplied by individual nerve roots. When the eruption is limited but to a portion of the area supplied by a spinal nerve root, sometimes, as I have remarked, the presence of an area of hyperæsthesia completes the field of the cutaneous supply. However, from a large collection of cases it will be found that the eruption occurs with marked regularity in definite areas, and that when it oversteps such definite areas it is found to do so in very definite directions. The directions in which it tends to spread can then be fairly judged to be that in which a higher or lower neighbouring root is affected.

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[1] Voigt, C. A., "Beiträge zur Dermato-Neurologie nebst der Beschreibung eines Systems neu endeckter Linien an der Oberfläche des menschlichen Körpers." Wien, 1864.

[2] Sherrington, C. S., "Notes on the Arrangement of some Motor Fibres in the Lumbosacral Plexus," *Journal of Physiology*, 1892, vol. xiii., p. 621.

In the accompanying figures the areas mapped out have been carefully drawn either from cases that have come under my own observation, or copied from recorded cases which were accompanied by figures representing the areas of distribution of the eruption. I thought it safer to give representations from those where the site of the eruption was illustrated by figures, rather than to attempt to give graphic representations founded on verbal descriptions. However accurate such verbal descriptions might be, it was felt that to make drawings from such reports might lead to misrepresentations, so that those cases, accompanied by drawings, were taken as types, in preference to others often more instructive, but where the descriptions were merely verbal. In reducing the various-sized figures given by different authors to one size, I have given, as accurately as I could, the relative anatomical situation of the eruption. It will be seen that most of the cases come from Von Bärensprung's articles. These articles I have found a perfect storehouse of interesting facts and suggestive ideas. It is assumed here that the disease is located in the ganglia of the posterior spinal roots. This surmise of Von Bärensprung has been, on the whole, confirmed by the post-mortem examinations. From the consideration of the results of these post-mortem reports, it will be observed that not infrequently several ganglia may be diseased at the same time, and that it is even possible for only a portion of a ganglion to be affected, at all events of the Gasserian ganglion. This might account for the eruption in some cases occupying but a small tract of skin, known to be supplied by a given nerve, as when only one branch of the trigeminal nerve is affected. As I have already said, a limited eruption may be associated with pain and hyperæsthesia, extending over the whole area of the distribution of the affected spinal nerve or nerves. Thus one patient suffered from agonising pain on the left side, and I was able to map out a sickle-shaped band of hyperæsthesia, curving from the epigastrium round the chest to the level of the sixth and seventh dorsal vertebræ. After a couple of days a few vesicles appeared scattered over the left half of the epigastrium. The eruption never extended further. When the pain radiates from the region affected by the eruption, it usually does so in a very definite direction, namely, along the skin supplied by the nerves, whose roots are next to the diseased ganglion. The following is an illustration in proof of this statement. In a patient who suffered from a scanty herpetic eruption, limited to the left chest and armpit, the pain was wont to radiate with excessive violence down the inner side of the arm, and the ulnar half of the forearm, to the little and ring fingers; that is to say, the eruption occurred in the tract of the cutaneous distribution of the third dorsal nerve, and the pain extended to the distribution of the second and first dorsal and eighth cervical nerves.

Beginning with the arm, it will be found that the eruption caused by the disease of the third and fourth cervical nerves extends to a short extent upon the outer part of the arm. Fig. 1 is copied from a case figured by Von Bärensprung.[1] In a case given by Lesser,[2] the eruption is described as occupying a somewhat similar distribution, and the fourth cervical ganglion was found diseased.

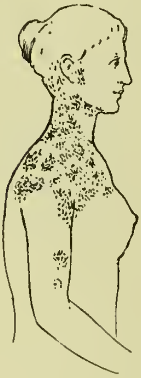

FIG. 1.

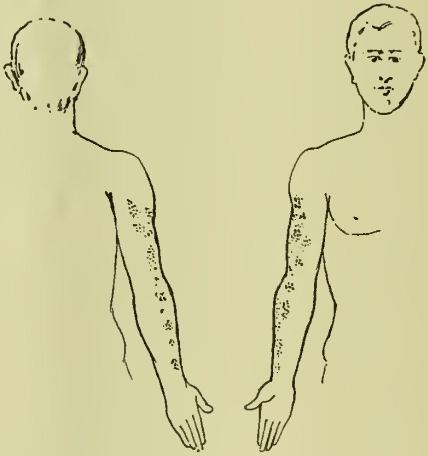

FIG. 2.

In herpes zoster of the fifth cervical ganglion, the eruption usually extends from the shoulder along the outer aspect of the shoulder and arm, and the radial half of the forearm. Such a case is reported by Bramwell (Fig. 2),[3] and the area occupied by the eruption here practically coincides with that mapped out by Ross, as the area of distribution of the fifth cervical nerve.

When the eruption is due to disease of the sixth cervical nerve, it is situated on the radial side of the thumb and forefinger, and it may affect the radial side of the forearm.

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[1] *Charité-Annalen*, Berlin, Bd. x., Heft i., Tafel iv.

[2] "Beiträge zur Lehre vom Herpes Zoster," *Virchow's Archiv*, 1881, Bd. lxxxvi., p. 391.

[3] "Studies in Clinical Medicine," 1889, vol. i., No. 3.

Adenot[1] describes a case where the eruption was limited to the back of the right thumb and second carpo-metacarpal joint. Stopin[2] relates two interesting cases. In the one the eruption was situated on the right hand and forearm. The vesicles occupied the thenar eminence, the posterior aspect of the thumb, the second interdigital space at the level of the metacarpo-phalangeal articulation, with two groups on the inferior third, and another on the superior third of the radial border of the forearm, and a few scattered vesicles at the bend of the elbow. In the other case the eruption was situated on the ball of the thumb and back of the left hand, while there was also an eruption occupying a similar area on the right hand, but extending a short way up the radial aspect of the forearm.

In Figs. 3 and 4 the eruption may be looked upon as occupying the area of distribution of the fifth and sixth cervical nerves. Fig. 3 is from a case that was under my own observation. The eruption occupied a similar area on the posterior aspect of the arm and forearm, but did not extend to the thumb. Fig. 4 is from a case figured by Pfeiffer,[3] to illustrate the distribution of the eruption, according to the distribution of the arteries. He endeavours to demonstrate that the course of eruption in herpes zoster is determined by the arterial supply, but all the cases he gives show, in a remarkable manner, the distribution of the eruption in regions supplied by definite spinal nerves. It will be observed that the eruption in the case of the fifth and sixth nerves varies in the extent of its distribution. Such variations are in accordance

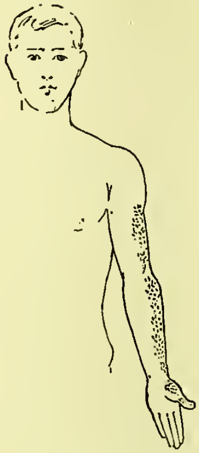

FIG. 3.

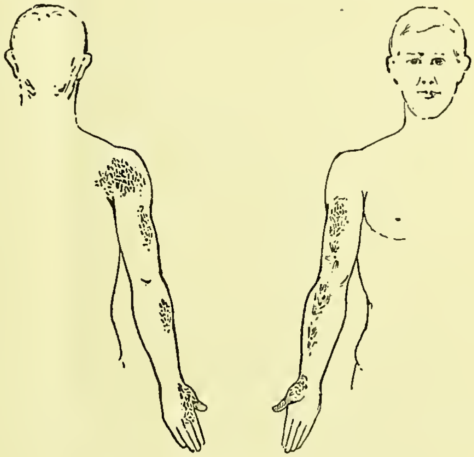

FIG. 4.

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[1] *Revue de médecine*, July 1891.

[2] "Le zona du membre superieur," Thèse No. 338, Paris, 1882, Observations iv. and xv.

[3] Pfeiffer, L., "Die Verbreitung des Herpes zoster längs der Hautgebiete der Arterien und dessen Stellung zu den acuten Exanthemen," Jena, 1889.

with the results obtained by Herringham from numerous dissections. In a case of tumour of the neck recorded by Buckley,[1] where there was an herpetic eruption, which occupied a similar area, the tumour was so situated that it would affect the fifth and sixth cervical nerves at their roots.

According to Herringham, the seventh cervical nerve is distributed to the fingers and hand, and the eighth cervical to the little and ring fingers, the ulnar border of the hand, and frequently also the forearm. I cannot find satisfactory accounts of cases where the eruption was limited to these areas, but they are found associated with the eruption produced by disease of neighbouring spinal nerves.

Thomson describes a case [2] where the eruption involved " the areas of skin supplied by the internal cutaneous nerve of the right brachial plexus, where there were also two groups of vesicles on the palm of the hand." Stopin [3] describes a case with the eruption in almost the same situation, namely, above the internal condyle of the humerus, on the inferior internal part of the forearm, and immediately above the carpus. In both these cases the first dorsal nerve is evidently affected. Herringham observed that in the majority of cases the internal cutaneous nerve was made up of fibres from the first dorsal root.

The area thus described as being supplied by the eighth cervical and first dorsal nerves is also practically that found anæsthetic by Horsley, in a case where he divided the posterior roots of the eighth cervical and first dorsal nerves.[4]

It is to be noted that in cases of herpes occupying any area supplied by the nerves from the fifth cervical to the first dorsal there is no associated eruption on the trunk. It is usually assumed that the posterior primary divisions of the lower three cervical nerves contain no cutaneous branches, but in the eleventh edition of Gray's *Anatomy* there is recorded the result of some dissections, which demonstrated that these nerves did give off cutaneous filaments. It is also generally assumed that the intercostal branch of the first dorsal nerve contains no cutaneous filament, but Swan distinctly states that there is such a supply.[5] In no reliable account, of the many I have read, has there been any record of the eruption occurring on the trunk, either in front or behind, where herpes zoster affected the nerves from the fifth cervical nerve to the first dorsal.

When the eruption is due to disease of the second dorsal root it may occupy the chest in front and behind, as well as the inner aspect of the upper arm (Fig. 5).[6]

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[1] *American Journal of Medical Sciences*, July 1876.

[2] *British Medical Journal*, 26th April 1890.

[3] *Loc. cit.*, Observation iii.

[4] Gowers, W. R., "Diseases of the Nervous System," London, 1891, 2nd ed., vol. i., p. 81.

[5] Swan, J. A., "Demonstration of the Nerves of the Human Body," London, 1834, p. 73.

[6] Von Bärensprung, *loc. cit.*, 1861, Bd. ix., p. 84.

In Fig. 6 there is represented the distribution of the eruption, where the disease affected the whole of the inner portion of the hand and arm and part of the chest. It forms, with Fig. 4, a demonstration of the manner in which the eruption takes place in affections of all the nerves constituting the brachial plexus. It was taken from a case under the care of Dr. Keay of Colne, to whose courtesy I was indebted for the opportunity of observing it. The eruption extends from the forefinger, affecting all the fingers and the ulnar portion of the hand (seventh and eighth cervical nerves), up the ulnar half of the forearm in a broad band (eighth cervical and first dorsal nerves), the inner surface of the upper arm, and the chest (second dorsal nerve). On the chest in front there were two broad patches, one over the sternum and adjacent to the second and third left costal cartilage, and one near the anterior axillary fold. There were also a few scattered vesicles as high as the clavicle. Behind there was a cluster of vesicles over the scapular spine.

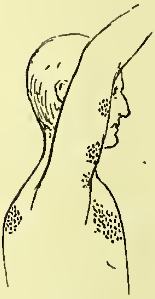

FIG. 5.

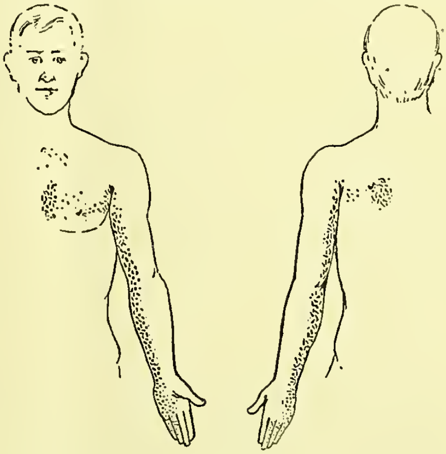

FIG. 6.

It will be observed that in herpes zoster of the arm the eruption pursues a definite course, when it affects the nerves in sequence below the fourth cervical; namely, descending on the outer aspect of the arm and forearm, affecting the hand from the radial to the ulnar side, and then ascending on the ulnar and inner aspect of the forearm and arm, and thus verifying, in a remarkable manner, the observations made by Herringham and Ross.

It will be seen that the course the eruption tends to pursue in the leg also agrees with that indicated by other observations.

In affections of the first lumbar nerve the eruption extends from the lumbar region round the upper part of the buttocks, slanting down over the hip. It is frequently associated with an eruption on the lower part of the abdomen and part of the external surface of the scrotum or vulva (Fig. 7).[1] The eruption in disease of the second lumbar nerve

[1] Von Bärensprung, *loc. cit.*, 1861, Bd. ix., p. 84.

root extends in a slanting direction from the lumbar region to the external and anterior surface of the thigh (Fig. 8),[1] while in that of the third there is likewise a band from the lower lumbar region, slanting down towards the anterior and internal surface of the thigh (Fig. 9).[2]

A very opportune landmark is just missed by what appears to be a slight error on Kaposi's part. In his work[3] he describes the post-mortem appearance of the ganglion of the third lumbar nerve, stating that it was taken from a case of herpes zoster lumbo-inguinalis. The term lumbo-inguinalis, as originally employed by Von Bärensprung, was used to describe the area of eruption in the distribution of the first lumbar nerve, as in Fig. 7. This term is also employed by Kaposi in the same sense, and the term lumbo-femoralis is used by him to describe the eruption on the anterior and internal surfaces of the thigh, and in the lumbar region, and he states that this area is supplied by the second, third, and fourth lumbar nerves. Thus, according to his statement, the third lumbar nerve is involved in the supply of the so-called lumbo-femoral area, and yet elsewhere he states that the third nerve was found diseased in a case of herpes zoster lumbo-inguinalis. If Fig. 9 be considered, it will be found that the eruption is situated partly in the lumbar and partly in the inguinal regions. I can only suppose that the term lumbo-inguinalis, in the case where the post-mortem examination is referred to, was used in the sense that the eruption was situated in the lumbar and inguinal regions, as in the case represented by Fig. 9.

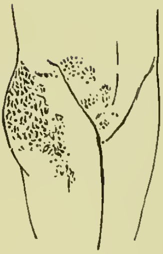

Fig. 7.

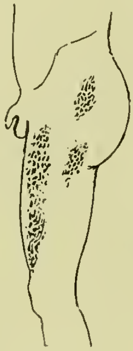

Fig. 8.

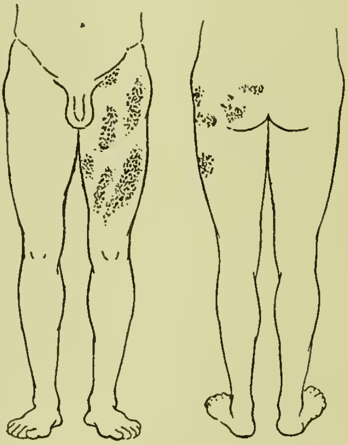

Fig. 9.

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[1] Von Bärensprung, *loc. cit.*, 1862, Bd. x.

[2] *Ibid.*, *loc. cit.*, Bd. x., Tafel iv.

[3] Kaposi, M., "Pathologie und Therapie der Hautkrankheiten," Dritte Auflage, Wien und Leipzig, 1887, p. 340, *et seq.*

When the fourth lumbar ganglion is diseased, the eruption extends mainly down the inner surface of the thigh and leg to the middle of the calf, with a slight eruption over the upper part of the sacrum (Fig. 10). This figure is taken from a female child, æt. 6, that I had under my care. The eruption extended from near the pubis, spreading from thence downwards, forwards, and slightly backwards to the middle of the calf. At the knee it spread round the front of the leg, and embraced the skin over the patella, then receded inwards to the middle of the calf. There was also a narrow band of vesicles extending in an outward direction over the upper part of the sacrum. In Fig. 11[1] the eruption occupied the whole of the outer, inner, and anterior aspect of the thigh, evidently in the areas supplied by the second, third, and fourth lumbar nerves. The space in the posterior surface is left quite free, and is the area occupied by the eruption when the lower sacral nerves are affected, as we shall shortly see. Hutchinson briefly describes a similar case.[2]

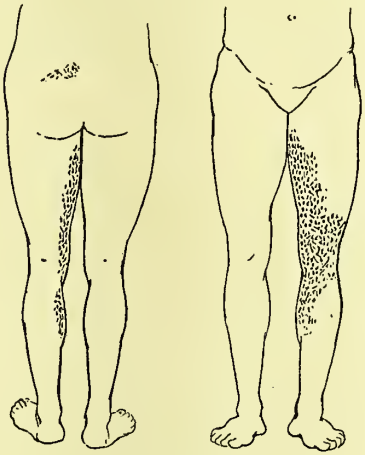
FIG. 10.

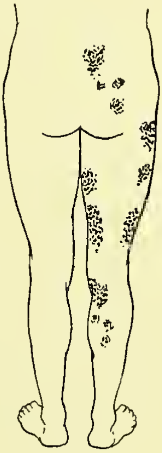
FIG. 11.

Accurate reports of cases of eruption below the knee are scarce, and it is hardly possible to determine the limits of the eruption in affections of the individual nerves with certainty. Taylor[3] describes a case where the eruption extended "along the course of the internal saphenous nerve from below the knee to the inner ankle." Blake[4] describes a case where the eruption was over the inner side of the leg below the middle of the calf, the inner ankle, and the dorsal and plantar surfaces of the foot (Fig. 12). In all probability Blake's case represents the area of distribution of the fifth lumbar nerve.

The eruption in the tract supplied by the first sacral nerve will be distributed over the outer surface of the foot and outer ankle, the second sacral probably on the outer surface of the leg. In a case described by Charcot[1] the herpetic eruption was situated on the "antero-external surface" of the left leg. "The first group of vesicles is seen above and below the patella; a larger group is disposed in a vertical straight line, which descends to the middle third of the leg; the third group occupies the neck of the foot in front of and inside the external malleolus." . . . "At the cauda equina, on the left side, we found adhering to one of the posterior roots, which give origin to the sacral plexus, an arteriole . . . distended by a blood clot." Unfortunately, the particular spinal nerve is not mentioned, otherwise the case might have served as a landmark to indicate the distribution of neighbouring nerves more exactly.

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[1] Von Bärensprung, *loc. cit.*, Bd. ix., p. 94.

[2] Hutchinson, J., *London Hospital Reports*, 1866, Case 52.

[3] *British Medical Journal*, 6th July 1889.

[4] *Birmingham Medical Review*, December 1884.

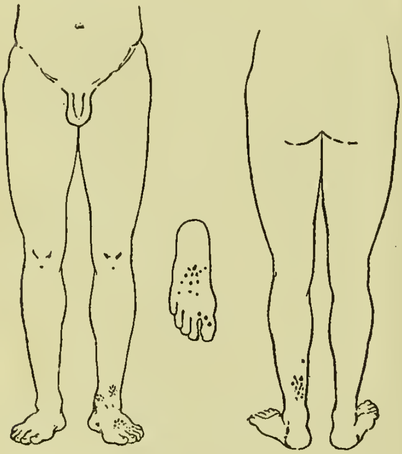
FIG. 12.

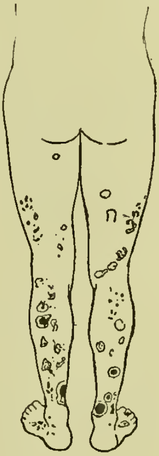
FIG. 13.

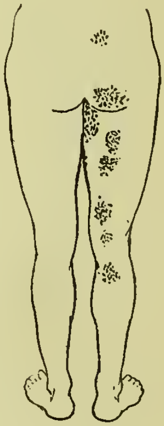
FIG. 14.

Moers[2] reports a case of herpes zoster, the vesicles in some places resembling pemphigus, where the eruption extended from the dorsum of the foot up the outer and back part of the leg and thigh (Fig. 13). The eruption here probably occupied the area of distribution of the first, second, and part of the third sacral nerves.

Thomas[3] describes a case with the distribution in a somewhat similar situation, namely, on the outer surface of the leg, under the knee, over the dorsal and plantar surfaces of the foot, and between the toes, as well as over the gluteus muscle near the middle line.

The posterior surface of the thigh is supplied by the third and fourth sacral nerves, and when the eruption occurs in this position it is associated with an eruption over the sacrum, along the perineum, and over the inner part of the scrotum or vulva of the side affected. Fig. 14[4] represents such an area of distribution. The right half of the scrotum was likewise affected, and the skin between the patches was hyperæsthetic.

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[1] "Diseases of the Nervous System," New. Syd. Soc., 1877, p. 69.

[2] *Deutsches Archiv der klin. Med.*, Mai 1868, Tafel v.

[3] *Archiv der Heilkunde*, 1868, ix., p. 475.

[4] Von Bärensprung, *loc. cit.*, Bd. ix., p. 102.

A not infrequent locality for the occurrence of the eruption is over the buttocks, along the perineum, over the internal portion of the scrotum or vulva of the side affected, and for a short distance down the thigh. Figs. 15[1] and 16[2] represent characteristic instances of this distribution, and in all probability indicate the cutaneous distribution of the fourth sacral nerve.

Fig. 17 was taken from a photograph of a case under the care of my friend, Dr. Robertson of Ventnor. The area here affected is that supplied by the lowest two sacral and the coccygeal nerves. The perineum and scrotum were not affected by the eruption.

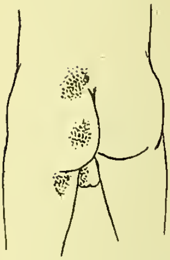

FIG. 15.

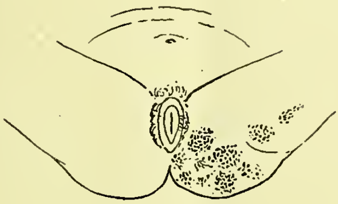

FIG. 16.

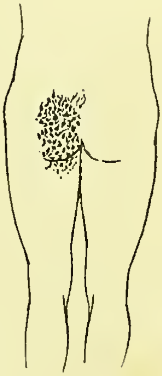

FIG. 17.

It must not be considered that the foregoing description is complete, or that it is correct in all particulars. The areas of distribution of the individual nerves in the leg are not as fully understood as are those in the arm. More accurate accounts of the distribution of the eruption in herpes zoster would assist to dispel much of the obscurity that still surrounds the subject. I am not by any means certain, for instance, that the case from which Fig. 10 was drawn represents the fourth lumbar nerve in its entirety in all cases. The anterior crural nerve is made up of fibres from the second, third, and fourth lumbar roots, and the long saphenous branch of the anterior crural supplies the inner side of the leg and foot. Presumably, therefore, the fourth lumbar nerve extends to the foot, although the long saphenous nerve sometimes does stop short at the ankle. It may be that the case given by Taylor was a case of disease of the fourth lumbar ganglion. The description here differs materially from that given by Starr.[3] He assumes, for instance, that the outer surface of the leg is supplied by the fifth lumbar nerve, but a consideration of his facts does not warrant us in accepting his

[1] Von Bärensprung, *loc. cit.*, Bd. ix., p. 100.

[2] *Ibid.*, *loc. cit.*, Bd. ix., p. 101.

[3] Starr, M. A., *loc. cit.*, p. 31.

conclusions. The description here given agrees more accurately with that given by Ross, and the course of the nerve distribution from the higher centres to the lower may be taken to be fairly accurate, although the delimitation of the individual nerve distribution may not be quite trustworthy.

4. Results of Post-Mortem Examinations.

The surmise of Von Bärensprung that the seat of disease in herpes zoster would be found in the ganglia of the posterior roots has been confirmed by a considerable number of post-mortem examinations. While admitting the occurrence, in rare cases, of herpes from disease of the nervous system in situations more central, as well as more peripheral, I think the evidence goes fairly conclusively in favour of Von Bärensprung's view. The points in this evidence are, firstly, the frequent occurrence of the eruption in areas peculiar to the cutaneous distribution of a spinal root; secondly, when variations occur in the extent of this area, they often correspond with those found by careful dissection of the nerves; thirdly, when the eruption extends over an area greater than that which one spinal nerve root supplies, it follows the area of cutaneous distribution peculiar to neighbouring nerve roots.

These points are not absolute, and exceptions can be found to them, but the eruption in what one might call the ordinary idiopathic herpes generally tends to conform to them. Support is obtained for these views from the study of the post-mortem results. The careful records of autopsies are rare, and in the nature of things this cannot but be so, inasmuch as herpes zoster is not of itself a fatal disease, and it is only when complications arise that death ensues. I will here give, in brief review, the records of such post-mortem examinations as I have been able to find.

Kaposi[1] gives a very full description of the morbid appearance of the spinal ganglion in herpes zoster. He shows that the blood-vessels supplying all the structures of such a ganglion are greatly engorged, and that numerous small hæmorrhages occur. The nerve-cells of the ganglion are compressed, and their contents destroyed, and the capsules of the nerve-cells may become distended with effused blood-corpuscles.

Von Bärensprung[2] found, in a case of "Zoster dorso-pectoralis dexter," where there was a hæmorrhagic eruption, which ultimately developed into gangrenous ulcers, and slowly healed (the patient dying six weeks after), an inflammatory condition of the sixth, seventh, and eighth dorsal ganglia, and the adjoining part of the nerve.

Weidner[3] reports a case where the eruption occurred on the left shoulder and upper arm, and on post-mortem examination there was found disease of the sensory root of the first dorsal nerve.

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[1] Kaposi, *loc. cit.*

[2] *Charité-Annalen*, Berlin, Bd. xi., Heft 2, p. 100.

[3] *Berlin. klin. Wochenschrift*, 1870, No. 7.

Wagner[1] found swelling of the spinal ganglion of the nerve in the cutaneous distribution of which herpes had occurred during life. There was caries of the vertebræ, pachymeningitis, and phthisis.

Lesser[2] reports two cases where the eruption was in the tract of, and associated with, disease of the ganglion of the fourth cervical nerve of the right side in one case, and of the eighth dorsal nerve in the other case. The same author reports another case[3] where the eruption occurred on the right side of the chest, and there was found degeneration of the fibres of the fifth dorsal nerve, with changes in the ganglia of the fifth and fourth dorsal roots, but no change in the fourth nerve.

Charcot and Cotard[4] describe a case of cancer of the vertebræ, in which there was a herpetic eruption in the neck. The spinal ganglia and nerve trunks supplying this area "were found tumefied and of a blood red colour," while the cord itself and nerve roots were unaffected.

Charcot[5] describes a case in which an artery containing an embolism pressed upon the posterior root of one of the sacral nerves, where there had been a herpetic eruption in the leg.

Chaudeleux[6] describes a case of herpes pectoralis, where the second and third dorsal ganglia were enlarged, and contained a deposit of pigment, with a disappearance of nerve-cells and fibres, and degeneration of the nerves.

Hebra[7] mentions a case of herpes zoster, with disease of the spinal ganglion supplying the region affected by the eruption.

Pitres et Vailard[8] report a case of old herpes in the region of the sixth dorsal nerve, and of a recent attack in the distribution of the eleventh dorsal nerve. There was found degeneration of the sixth nerve and ganglion, and degeneration of the eleventh nerve, while the eleventh ganglion was intact.

Dubler,[9] in a case of intercosto-abdominal herpes, found disease of the ninth intercostal nerve and ganglion, disease of the tenth intercostal nerve, but no disease of the tenth spinal ganglion.

The functions of the Gasserian ganglion subserve the same ends to the fifth cranial nerve that the spinal ganglia do to the spinal nerves.

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[1] *Archiv der Heilkunde*, 1870, Heft 4, p. 32.

[2] "Beiträge zur Lehre vom Herpes Zoster," *Virchow's Archiv*, 1881, Bd. lxxxvi., p. 391.

[3] *Virchow's Archiv*, 1883, Bd. xciii., p. 506.

[4] "Sur un cas de zona du cou avec altération des nerfs du plexus cervical et des ganglions correspondants des racines spinal postérieures," *Memoires de la Société de Biologie*, 1865, p. 41; also Charcot "Diseases of the Nervous System," *New Syd. Society*, 1877, p. 24.

[5] "Diseases of the Nervous System," *New Syd. Society*, 1871, p. 69.

[6] *Archives de Physiologie norm. et path.*, 1879.

[7] Quoted by Dubler in *Virchow's Archiv*, 1884, Bd. xcvi.

[8] *Archives de neurologie*, Paris, 1883.

[9] *Virchow's Archiv*, 1884, Bd. xcvi.

In like manner, in herpes of the skin supplied by the fifth nerve, there has frequently been found disease of this ganglion.

Wyss[1] describes a case of herpes occurring in the distribution of the first branch of the fifth cranial nerve of the right side, where there was found disease of the right Gasserian ganglion, limited to the portion associated with the first branch.

Kaposi[2] has found disease of the Gasserian ganglion in a case of herpes frontalis.

Sattler[3] records a case of poisoning by carbonic acid gas, in which right frontal herpes occurred, and in the right Gasserian ganglion there was found round-celled infiltration of the ganglion, with destruction of the nerve-cells, and degeneration of the fibres of the outgoing nerve.

Weidner,[4] in a case that died five years after herpes zoster in the tract of the right trigeminal nerve, found atheroma of the arteries of the brain, with changes at the root of the right fifth nerve at its origin in the medulla. The right Gasserian ganglion was found thinned and altered microscopically.

While numerous cases have thus been found in which the ganglia have been diseased, there are also numerous others on record where the cause of the eruption must have been more central in its situation. Thus it has been found in cerebro-spinal meningitis, myelitis, sclerosis of the posterior columns, progressive muscular atrophy, etc. It can also undoubtedly arise from a peripheral neuritis, induced by injuries to the nerve (wounds, pressure by inflamed bones, perineuritic swellings). The cases quoted above from Pitres et Vailard, and Dubler, lend countenance to Dubler's view, that the neuritis is primary and the affection of the ganglia secondary, were it not that the majority of recorded cases contradicted it.

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[1] *Archiv der Heilkunde*, Leipzig, 1871.

[2] *Loc. cit.*

[3] *Stricker's Med. Jahrb.*, 1876, quoted by Dubler, *supra.*

[4] *Berlin. klin. Wochenschrift*, 1870, No. 7.